Working Paper

Department of Finance

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101-06319/

Effective Income Tax Rates In Macroeconomics:

An Update For Canada

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Working Paper 97-05
May 1997

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* We would like to thank Maxime Fougère, Enrique Mendoza, Marcel Mérette, Linda Tesar and Jing Xu for their comments on a previous version of this paper. The views expressed in this paper are solely those of the authors. No responsibility for them should be attributed to the Department of Finance.

Abstract

Summarising tax structures with single indicators of tax rates for use in macroeconomics models and general equilibrium simulations is a difficult task. Based on the approach suggested by Lucas (1991, 1990) and Razin and Sadka (1993), Mendoza, Razin and Tesar (1994) developed time series of effective tax rates on labour income, capital income and consumption for the G-7 countries. We show that, in the case of Canada, accounting for the appropriate allocation of special income tax provisions (commonly known as tax expenditures) between labour and capital income yields effective tax rates on labour income which are higher than the corresponding rates on capital income, the opposite of the result obtained by Mendoza, Razin and Tesar (1994).

Résumé

Résumer les structures fiscales avec des indicateurs uniques des taux d'imposition afin de les utiliser dans les modèles macro-économiques et les simulations d'équilibre générale est une tâche difficile. Sur la base de l'approche suggérée par Lucas (1991, 1990) ainsi que Razin et Sadka (1993), Mendoza, Razin et Tesar (1994) ont élaboré des séries chronologiques de taux d'imposition effectifs sur le revenu du travail, le revenu du capital et la consommation pour les pays du G-7. Nous montrons que dans le cas du Canada, le fait de tenir compte de la répartition adéquate des dispositions spéciales de l'impôt sur le revenu (ce qu'on appelle communément les dépenses fiscales) entre le revenu du travail et le revenu du capital, produit des taux d'imposition effectifs sur le revenu du travail plus élevés que les taux correspondants sur le revenu du capital, soit le contraire du résultat obtenu par Mendoza, Razin et Tesar (1994).

I. Introduction

Increasingly, the economic effects of distortionary taxes are being evaluated with the help of computable general equilibrium models (CGE)[1]. The results obtained by simulating alternative tax systems differ depending on the structure of the model and the assumed values of key parameters. Some models are static while others are dynamic and can trace the transition path from the initial equilibrium to a new steady state. Some models represent a closed economy while others reflect a small open economy. Some models ignore human capital while others incorporate it in different ways. The effect of differences in the magnitude of the estimated growth effects of tax reform due to variations in the values of key parameters was analysed by Stokey and Rebelo (1995). They show that the critical parameters in determining the size of these effects are factor shares, depreciation rates, the elasticities of intertemporal substitution and of labour supply.

One of the difficulties analysts has faced in simulating changes in the tax structure is the measurement of tax rates which are suitable for the model being used and also provide a realistic representation of the tax system. In a recent paper, Mendoza, Razin and Tesar (1994), hereafter referred to as M-R-T, developed time series of effective tax rates on labour income, capital income and consumption for the G-7 countries: United States, United Kingdom, France, Germany, Italy, Canada and Japan.

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[1] See, for example, Pecorino (1993, 1994), Jones, Manuelli and Rossi (1993), King and Rebelo (1993) and Lucas (1990).

The approach used by M-R-T in calculating the effective tax rates on labour and capital income involves a high degree of aggregation and fails to incorporate key elements of the personal income tax. In particular, their calculations assume that the special credits and deductions incorporated in the personal income tax are allocated between capital and labour income on the basis of the relative shares of these income sources in the national accounts. To the extent that the structure of these credits, exemptions and deductions deviates from the weights in accordance with the national income shares used by M-R-T, the estimated tax rates on capital and labour income will differ from the estimates using the aggregate approach. In this paper, we show that, in the case of Canada, accounting for the appropriate allocation of special provisions between labour and capital income yields effective tax rates on labour income which are higher than the corresponding rates on capital income, the opposite of the result derived by M-R-T. This change occurs via the personal tax on capital income component.

II. Methodology

A. Concepts

The increased use of computable general equilibrium models in the assessment of the impact of various policy alternatives has raised some concerns regarding the way different tax structures are incorporated in these models. While the existing literature suggests the combination of various sources of information on taxation, income distribution and on individuals from household surveys to create aggregate marginal tax rates, this approach has some severe

limitations[2]. As Frenkel, Razin and Sadka (1991) point out, this approach does not take into account the complexity of the tax system (exclusions, credits, deductions, exemptions) nor the interactions between its different components. In addition, as pointed in Mendoza, Razin and Tesar (1994), it is not clear whether the aggregate tax rates used to assess macroeconomic implications are equivalent to those that apply to individuals. Finally, the computation of aggregate marginal tax rates is considerably limited by data availability.

Based on the theoretical framework developed by Lucas (1990, 1991) and by Razin and Sadka (1993), Mendoza, Razin and Tesar (1994) propose an alternative approach to the computation of aggregate tax rates. This approach tabulates aggregate effective tax rates using data on the actual tax payment and from the national accounts. More specifically, their approach calculates the *ad valorem* tax rates on consumption, labour and capital income faced by a representative agent in a general equilibrium framework. The tax rates are calculated as the ratio of the difference between the pre-tax and post-tax valuation of consumption, labour and capital income, respectively (approximated by the tax revenue obtained from each tax), to their respective tax bases. The tax bases are measured as the pre-tax values of consumption, labour and capital income.

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[2] For the use of aggregate marginal tax rates, see, for example, Easterly and Rebelo (1993), OECD (1991), Auerbach (1987) and McKee, Visser, and Saunders (1986).

B. Measurement

1. The Effective Tax Rate on Labour Income

M-R-T calculate the effective tax rate on labour income (t_l) in two steps. First, they estimate the portion of the personal income tax (PIT) which is borne by wages (W); second, they add to this value the estimated total social security contributions (PT) (payroll taxes) and divide the resulting sum by the combined amount of wages and employers' contributions to social security (PTe).

In estimating the value of the personal income tax on wages, M-R-T assume that the effective personal income tax rates on household income (t_h) are equal for wage (W) and non-wage income (Z). Following their approach, the value of t_h can be calculated as:

$$t_h = \frac{PIT}{(W+Z)} \qquad (1)$$

where Z includes household's property and entrepreneurial income plus the operating surplus of private unincorporated enterprises. The amount of PIT revenue assigned to wages (R_w) can then be estimated as:

$$R_w = t_h \cdot W = a \cdot PIT \qquad (2)$$

where $a = \frac{W}{Z+W}$

Expression (2) shows that, under the approach used by M-R-T, the PIT revenue is allocated between wage and non-wage income in accordance with their shares in national income. This approach implies either that the PIT has a comprehensive base or that the various special income tax provisions (commonly known as tax expenditures) reduce the tax payable on wage and non-wage income in proportion to their shares in national income.

These implicit assumptions misrepresent the structure of the personal income tax and greatly bias the results. Ruggeri and Vincent (1996) have shown that for selected OECD countries - Canada, United States, United Kingdom, Australia and France - the PIT base falls considerably short of a comprehensive concept. Moreover, the structure and objectives of the special provisions differ considerably among countries, suggesting that the relative position of the different countries with respect to the taxation of capital and labour income will be altered when the tax rates are calculated by using a more detailed approach[3]. For example, in Canada an important share of tax expenditures, in terms of tax revenue forgone, is tax preferences for various forms of savings. When these tax preferences are correctly assigned to capital income rather than to labour income, the estimated effective tax rates on capital and labour income will be greatly affected.

An effective way of taking into account the tax expenditures in the calculation of effective tax rates on labour is to consider each tax expenditure separately and calculate an adjustment value (M) that determines which proportion of the tax revenue forgone it generates should be

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[3] A detailed list of tax expenditures in fourteen countries, including six of the seven countries considered in the M-R-T study, is found in OECD (1996).

assigned to labour income[4]. If we call this proportion b_i, where i is the ith tax expenditure (X), we can define the adjustment value M as:

$$M = \sum_i (aX_i - b_i X_i) \tag{3}$$

Since some of the tax expenditures are received by members of society who are not generally in the labour force and do not earn capital income, we have made an adjustment to t_h and calculated t_h' by adding the revenue loss from the tax expenditures aimed at these groups to the total PIT revenue and allocated it in accordance to the shares of wages and non-wage income[5]. With the above adjustments, the PIT revenue assigned to wages becomes:

$$R_w' = t_h' \cdot W + M \tag{4}$$

Using M-R-T's approach, the tax rate on labour income (t_l) is calculated as:

$$t_l = \frac{(R_w + PT)}{(W + PTe)} \tag{5}$$

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[4] In the calculations, the values of the individual tax expenditures are summed up to give us the total. It is known that the combined effect may be different because of interactions among different tax expenditures (as correctly stressed by the Department of Finance's publication (1995)). However, as shown by Fougère, Ruggeri and Vincent (1996), in the case of Canada, the sum of the individual effects of major tax preferences on government tax revenues underestimates their full impact (taking into account all interactions) by only 3 per cent.

[5] These tax expenditures are the non-taxation of Royal Canadian Mounted Police (RCMP) pension/compensation for injury, disability or death, the non-taxation of veterans' disability and support for dependants, the non-taxation of veterans' allowances, civilian war pensions and allowances and other pensions, the age credit, the pension income credit and the disability credit. This adjustment raised the value of t_h by approximately 0.3 percentage points, but did not affect the difference between t_l and t_k.

As mentioned above, the expression (5) must be adjusted in order to take into account the effects of the tax expenditures. In our updated calculations for Canada, we made two adjustments to the calculation of t_l. First, we replaced R_w with R_w' on the basis of the above discussion. Second, we added to the value of W in the denominator the estimated income associated with the tax expenditures benefiting labour income (SLI)[6]. In our view, that amount should be considered as part of the pre-tax compensation to labour. As a result of these adjustments, the expression used in our calculations becomes:

$$t_l' = \frac{\left(R_w' + PT\right)}{\left(W + SLI + PTe\right)} \qquad (6)$$

2. Effective Tax Rate on Capital Income

In M-R-T's approach, the tax rate on capital income (t_k) is calculated as:

$$t_k = \frac{\left(t_h \cdot Z + O\right)}{S} \qquad (7)$$

where O is the amount of all other taxes on capital income or capital assets and S is the total operating surplus of the economy. Since there are only two income sources taxed under the PIT, labour and capital income, the adjustment made to the proportion of PIT assigned to labour must be reflected by an adjustment of equal amount - but in the opposite direction - for the tax

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[6] The estimated income added to the denominator arises from the following tax expenditures benefiting labour income: non-taxation of employer-paid insurance premiums for group private health and welfare plans, non-taxation of strike pay, non-taxation of worker's compensation benefits and employers' contributions to registered pension plans (RPP).

assigned to capital. With this adjustment, M-R-T's expressions for the effective tax rate on capital income becomes:

$$t_k' = \frac{\left(t_h' \cdot Z + O - M\right)}{S} \qquad (8)$$

Expression (8) differs from M-R-T's formula only by the inclusion of (-M) and the use of t_h' instead of t_h[7].

III. Results

The updated effective tax rates on labour and capital income presented in this paper were based on data from the OECD *National Accounts* and *Revenue Statistics* (the same source used by M-R-T). We used the same definitions employed by the authors and based the adjustments on the estimates of the tax revenue forgone from tax expenditures contained in the annual report on tax expenditures prepared by the Department of Finance[8]. A list of these tax expenditures, the tax revenue forgone they generate and our suggested allocations are shown in appendix Table 1-A. The adjusted estimates of t_l and t_k for Canada for the years 1988 through 1993 are presented in

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[7] There was no need to adjust S since by definition, the operating surplus of the economy is exhaustive and thus already includes the special tax provisions on the corporate side.

[8] In order to reflect both the federal and provincial tax expenditures, the tax expenditure estimates published by the Department of Finance were multiplied by a factor of 1.55 (the rule of thumb for the provincial PIT being 0.55 for the 1988-1993 time period).

Figures 1 and 2, where they are compared with the unadjusted estimates based on M-R-T's formulas[9] (Table 1-B in the appendix provides the values of t_l and t_k under both approaches).

Figure 1 shows that, ignoring the effects of the tax expenditures will result in an underestimate of the tax rule on labour income by about four to five percentage points through the 1988-1993 time period. In 1993, the last year for which published tax expenditures data were available, the effective tax rate on labour in Canada was estimated at 36.4 per cent compared to 31.3 per cent according to the formula used by M-R-T. The evolution of the tax rates through time is, however, very similar under both approaches. From 1988 to 1993, the value of t_l increased by 3.2 percentage points under the adjusted measurement compared to 3.0 percentage points under M-R-T's approach.

An opposite and much larger difference between the two approaches was found for the effective tax rate on capital income (see Figure 2). The adjusted value of t_k for 1993 was calculated as 28.7 per cent compared to an unadjusted value of 49.5 per cent. The reason for a much larger difference in the case of the tax rate on capital income is its smaller base. Since the adjustment at the numerator of the tax rate formulas is equal in amount for both tax rates, its effects will be larger for the tax with the smaller base. We also notice a substantial difference in the evolution of the values of t_k through time. From 1988 to 1993, the adjusted value of t_k rose by 4.0 percentage points or less than half of the 10.4 percentage points increase in the unadjusted value.

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[9] Prior to 1988, the tax expenditures' estimates were not published on an annual basis. Thus, we were unable to provide a consistent time series for the entire period covered by M-R-T.

Figure 1

Effective Tax Rates on Labour Income, 1988-1993

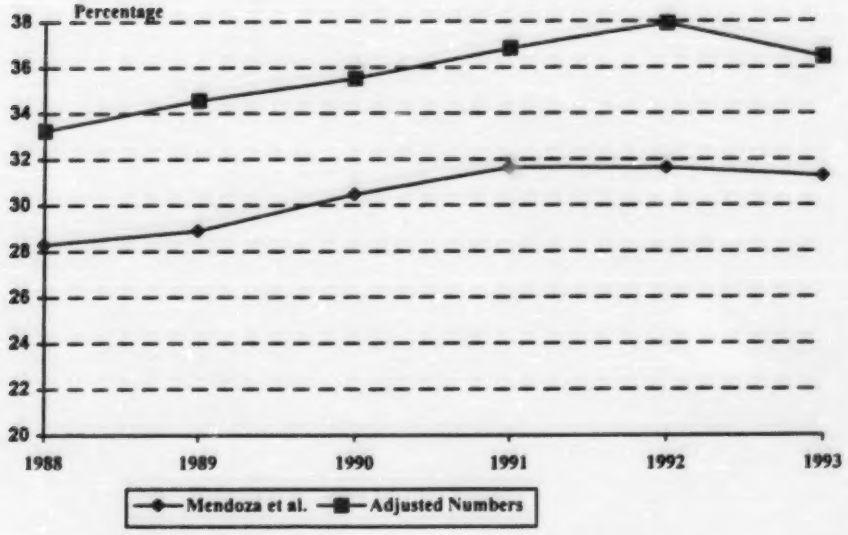


Figure 2

Effective Tax Rates on Capital Income, 1988-1993

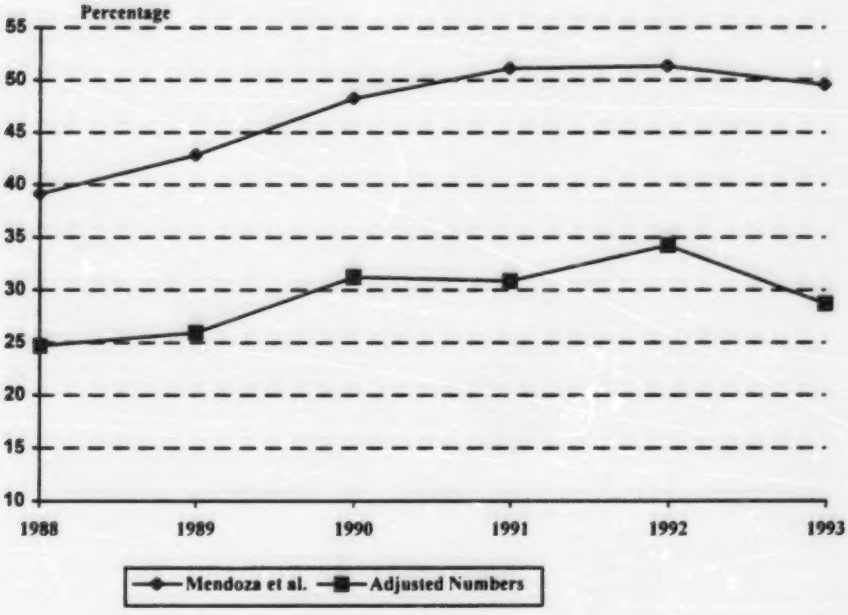
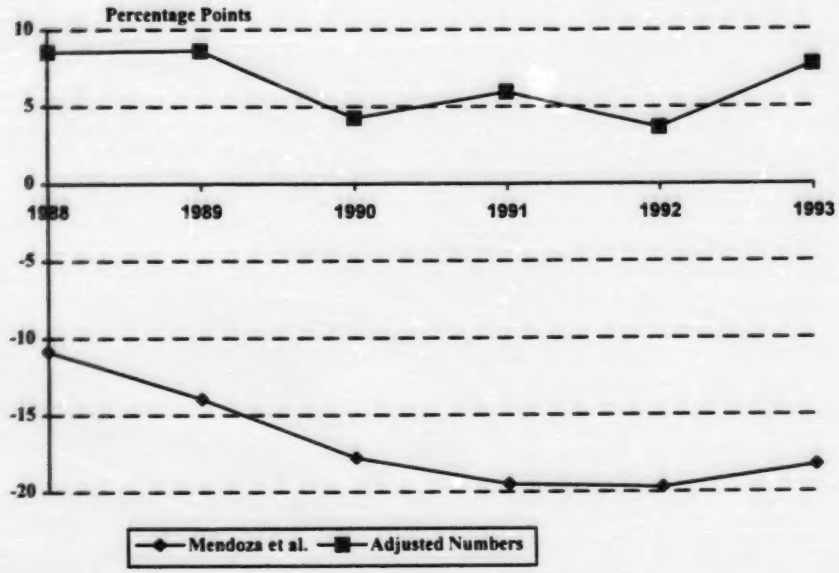


Figure 3

Differential Between Labour and Capital Effective Tax Rates, 1988-1993



A comparison of the difference between t_l and t_k under the two approaches is shown in Figure 3. It is quite evident that the two approaches yield very different conclusions. M-R-T's results show that the effective tax rate on capital income is much higher than the corresponding rate for labour income and this gap has widened through time, moving from 10.8 percentage points in 1988 to 18.3 percentage points in 1993. Our adjusted results lead to the opposite conclusion. The effective tax rate on labour income is higher than that on capital income, but the difference has narrowed slightly through time falling from 8.6 percentage points in 1988 to 7.8 percentage points in 1993.

IV. Conclusion

Summarising tax structures with single indicators of tax rates for use in macroeconomics models and general equilibrium simulations is a difficult task. Highly aggregate indicators contain the risk of misrepresenting the tax structure. In this paper, we have shown the importance of adjusting the approach used by M-R-T to take into account that the special provisions of the PIT affect in different proportions labour and capital income. In the case of Canada, it reverses the sign of the difference between taxes on labour and capital income. Since countries with personal income taxes make different use of tax expenditures, taking account of these special provisions not only alter the results for a single country, but may affect significantly the comparison among countries. Although the allocation of tax expenditures between labour and capital involves a certain degree of arbitrariness, the large change in the estimated values of the effective tax rates that they produce suggests that ignoring them would yield a misleading picture of the tax structures of different countries and of their changes through time.

It should be noted that the adjustments to the calculations by Mendoza, Razin and Tesar (1994) provide a more accurate series of effective tax rates, but do not address the fundamental issues of the appropriateness of using such rates in policy simulations. Generally, efficiency effects of taxation arise from changes in marginal rather than average tax rates. Therefore, one would expect that, even in representative agent models, it would be preferable to use an appropriate average of marginal tax rates rather than effective tax rates. The two rates would be equal under broad-based proportional taxes and one may argue that the effective tax rates should

be used only in simulations involving such taxes. For tax policy options involving multi-rate taxes, even an average of marginal tax rates may be inappropriate. As shown by Souissi, Beauséjour, Vincent and Ruggeri (1997), for example, the use of a representative agent model would overestimate the potential efficiency gains of flattening the tax rate schedule of the personal income tax if labour supply elasticities decrease with the level of skills and income.

In an economy that is to some degree open, personal capital and corporate taxes will have differing effects. For example, in a small open economy, personal capital taxes would affect national savings, but not investment, while corporate taxes would affect investment. The revisions suggested in this paper occur entirely on the personal side, with economic implications that are likely weighted to savings rather than investment. The importance of this distinction suggests that aggregate capital tax measures should be viewed cautiously in a CGE modelling context.

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Table 1-A

Personal Income Tax Provisions Allocated as Capital (K), Labour (L) or General[a] (G) Tax Provisions

Personal Income Tax Expenditures	Value 1993 (millions)	Allocation (K/L/G)
Education, Culture, Family and Health		
Flow through of CCA on Canadian films	16	K
Exemption on first $500 of scholarship, fellowship and bursary income	7	L
Tuition fee credit	175	L
Education credit	43	L
Education and tuition fee credit transferred	190	L
Married credit	1,205	G
Equivalent-to-married credit	455	G
Dependant credit	12	G
Child tax benefit	5,275	G
Non-taxation of employer-paid insurance premiums for group private health and welfare plans	1,200	L
Medical expense credit	260	G
Employment		
Non-taxation of strike pay[1]	n.a.	L
Non-taxation of allowances for volunteer firefighters	4	G
Northern benefits deductions	190	G
Overseas employment credits	33	L
Employee stock options	57	K
Farming, Fishing and Resource		
$500,000 lifetime capital gains exemption for farm property	405	K
Deferral through ten-year capital gain reserve	-5	K
Deduction of resource-related expenditures	78	K
General Business and Investment		
$100,000 lifetime capital gain exemption	1,170	K
Partial inclusion of capital gains	1,185	K
Deduction of research and development expenditures	3	K
Deduction of limited partnership losses	215	K
Deferral through five-year reserve	-33	K
Investment tax credit	125	K
Income Maintenance and Retirement		
Non-taxation of worker's compensation payments	610	L
Treatment of alimony and maintenance payments	220	G
Registered retirement savings plans		
Deduction for contribution	4,490	K
Non-taxation of investment income	3,325	K
Taxation of withdrawals	-930	K
Registered pension plans		
Deduction for contribution	5,205	K
Non-taxation of investment income	8,610	K
Taxation of withdrawals	-4,930	K

Personal Income Tax Provisions Allocated as Capital (K), Labour (L) or General[a] (G) Tax Provisions (Continued)

Personal Income Tax Expenditures	Value 1993 (millions)	Allocation (K/L/G)
Small Business		
$500,000 lifetime capital gains exemption for small business shares	1,170	K
Deduction of allowable business investment losses	100	K
Labour-sponsored venture capital credit	58	K
Deferral through ten-year capital gain reserve	5	K
Memorandum Items		
Non-taxation of capital gains on principal residences		
Full inclusion rate	2,735	K
Charitable donations credit	880	G
Gift to Crown credit	14	G
Political contribution credit	20	G
Child care expense deduction	305	L
Moving expense deduction	66	L
Deduction of carrying charges incurred to earn income	540	K
Deduction of farm losses for part-time farmers	50	K
Farm and fishing loss carry-overs	11	K
Capital loss carry-overs	89	K
Non-capital loss carry-overs	73	K
Deduction of other employement expenses	490	L
Deduction of union and professional dues	465	L
Deduction of meals and entertainment expenses	110	K
Dividends gross-up and credit	635	K
TOTAL	**36,681**	

[a] No adjustment was made when the tax expenditures were classified as general (G)

[1] Data on strike pay was not available in 1993.

Table 1-B

Effective Tax Rates on Labour and Capital Income, 1988-1993

Years	Labour Income		Capital Income	
	Mendoza et al.	Adjusted Numbers	Mendoza et al.	Adjusted Numbers
1988	28.29	33.25	39.14	24.7
1989	28.89	34.56	42.83	25.94
1990	30.47	35.51	48.26	31.25
1991	31.64	36.82	51.15	30.87
1992	31.63	37.91	51.33	34.25
1993	31.27	36.44	49.53	28.69

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